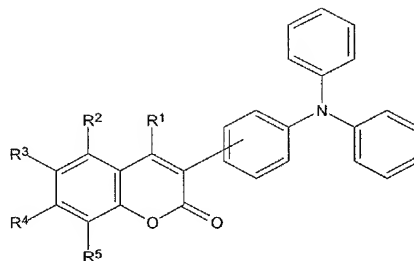


Amendments to the Specification

Please replace the paragraph beginning at page 4, line 26, with the following amended paragraph:

Further in view of such a situation, the present inventors researched and screened aromatic tertiary amines, resulting in the finding that an amine compound bearing within the same molecule one or more atomic groups represented by General Formula 1 is very useful as light-absorbing or luminescent agent in a variety of fields which require organic compounds with such properties because it gives an absorption maximum in the visible region and efficiently absorb a visible light, as well as because such an amine compound usually has a luminescent maximum in the visible region and a satisfiable stability, and emits a visible light when excited. Also was found that such amine compound emits a visible light with an elevated brightness when applied to organic EL devices as luminescent layer material such as host- or guest-compound, as well as that the emission consistently prolongs over a long period of time at ambient temperature.

General Formula 1:



(In General Formula 1, R¹ to R⁵ denote a hydrogen atom or substituent ~~independently~~ independent of each other.)

Please replace the paragraph beginning at page 6, line 6, with the following amended paragraph:

This invention is based on the creation of a novel aromatic tertiary amine compound and the discovery of its industrially useful properties. The amine compound of this invention would find a variety of uses as light absorbing or luminescent agent in various fields of, for example, photochemical polymerization, solar cell, optical filter, dyestuff, dye laser and analysis which require an organic compound with such properties because it has an absorption maximum in the visible region and efficiently ~~absorb~~ absorbs a visible light, as well as because such an amine compound usually has a luminescent maximum in the visible region and a ~~satisfiable~~ satisfactory stability, and ~~emit~~ emits a visible light when excited. In addition, the amine compound of this invention is very useful as luminescent agent in organic EL devices because it is formable into a stable membrane and

large in thermal stability when in a glass state. Further, the amine compound of this invention is useful as material to modify the chromaticity of luminescence in organic EL devices because it has an absorption maximum in the visible region and a large molecular absorption coefficient. Since the organic EL device using the amine compound of this invention is superior in luminescent efficiency and durability, it is very useful in illuminants in general, as well as in a variety of information displaying equipments, for example, those in panel form which are to visualize information such as those in images and words.

Please replace the paragraph beginning at page 7, line 28, with the following amended paragraph:

In General Formula 1, R^1 to R^5 denote a hydrogen atom or substituent ~~independently~~ independent of each other. The substituents in R^1 to R^5 are, for example, aliphatic hydrocarbon groups such as methyl, ethyl, propyl, isopropyl, isopropenyl, 1-propenyl, 1-propynyl, 2-propenyl, butyl, isobutyl, sec-butyl, tert-butyl, 2-butenyl, 1,3-butadienyl, pentyl, isopentyl, neopentyl, tert-pentyl, 1-methylpentyl, 2-methylpentyl, 2-pentenyl, 2-penten-4-ynyl, hexyl, isohexyl, 5-methylhexyl, heptyl, octyl, nonyl, decyl, and dodecyl groups; alicyclic hydrocarbon groups such as cyclopropyl, cyclobutyl, cyclopentyl, cyclopentenyl, cyclopentadienyl, cyclohexyl,

cyclohexenyl, cyclohexadienyl, cycloheptyl, cyclooctyl, and cyclooctadienyl groups; aromatic hydrocarbon groups such as phenyl, *o*-tolyl, *m*-tolyl, *p*-tolyl, xylyl, mesityl, *o*-cumenyl, *m*-cumenyl, *p*-cumenyl, biphenyl, naphthyl, anthryl, phenalenyl, phenanthryl, and pyrenyl groups; ether groups such as methoxy, ethoxy, propoxy, isopropoxy, butoxy, isobutoxy, *sec*-butoxy, *tert*-butoxy, pentyloxy, isopentyloxy, hexyloxy, aryloxy, phenoxy, and naphthyloxy groups; ester groups such as methoxycarbonyl, ethoxycarbonyl, propoxycarbonyl, acetoxyl, and benzoyloxy groups; amino groups such as methylamino, dimethylamino, ethylamino, diethylamino, propylamino, dipropylamino, isopropylamino, diisopropylamino, butylamino, dibutylamino, isobutylamino, diisobutylamino, *sec*-butylamino, *tert*-butylamino, pentylamino, dipentylamino, hexylamino, cyclohexylamino, piperidino, phenylamino, *N,N*-diphenylamino, naphthylamino, *N,N*-naphthylphenylamino, *N,N*-dinaphthylamino, and *N*-carbazolyl groups; halogen groups such as fluoro, chloro, bromo, and iodo groups; hydroxy group; carboxy group; cyano group; nitro group; and combinations thereof.

Please replace the paragraph beginning at page 8, line 25, with the following amended paragraph:

Examples of the amine compound according to this invention are those represented by Chemical Formulae 1 to 50. Each compound has an absorption maximum at a wavelength around

300 to 500 nm, usually, 400 to 470 nm and a large molecular absorption coefficient (1×10^4 or larger, particularly, 3×10^4 or larger) at the absorption maximum wavelength (a molecular absorption coefficient at an absorption maximum wavelength will be abbreviated as " ϵ " hereinafter), and as a result efficiently absorbs a light in the wavelength region. The amine compounds represented by Chemical Formulae 1 to 50 have a luminescent maximum such as fluorescence maximum at a wavelength around 500 to 650 nm, releasing a luminescence in the green to red region when excited. The amine compound of this invention usually has a decomposition point exceeding 400° and a glass transition point of 110° or higher. As well known, the decomposition point and glass transition point in organic compounds have been deemed to be a ~~merkmal~~ characteristic of their thermal stability: Organic compounds with higher decomposition and glass transition points are larger in thermal stability. Because of these, the amine compound of this invention is very useful in the field of organic EL devices which require luminescent organic compounds with a superior thermal stability. Both decomposition and glass transition points of the amine compound according to this invention can be determined by conventional differential scanning calorimetry analysis (abbreviated as "DSC analysis" hereinafter).

Please replace the paragraph beginning at page 29, line 13, with the following amended paragraph:

~~Dependently~~Depending upon use, the amine compound in a reaction mixture thus obtained may be used intact: However, prior to use, it is usually purified with a method(s) extensively employed in the purification of analogous compounds, such as dissolution, separation, decantation, filtration, extraction, concentration, thin layer chromatography, column chromatography, gas chromatography, high-performance liquid chromatography, distillation, sublimation, and crystallization, which may be applied in combination, if necessary. ~~Dependently~~Depending upon the types of amine compounds and uses of organic EL devices, it is desirable to highly purify the amine compound of this invention to be applied to organic EL devices by means of, for example, distillation, crystallization and/or sublimation, prior to its uses.

Please replace the paragraph beginning at page 29, line 25, with the following amended paragraph:

Among these, sublimation is superior to others because high-purity crystals can be easily obtained through a single step with a less loss of the amine compound during purification, as well as because solvent is not incorporated in crystals. Although both atmospheric and reduced pressure

sublimation methods are applicable in this invention, the latter method is usually employed. To sublime the amine compound of this invention *in vacuo*, for example, an adequate amount of the amine compound is placed in a sublimation purification apparatus, and then heated at possible lowest temperature, in particular, at a temperature lower than the melting point while keeping the pressure inside the apparatus at 10^{-2} Torr or lower, desirably, 10^{-3} Torr or lower so that the amine compound does not ~~cause decomposition~~decompose. When the purity of an amine compound to be subjected to sublimation purification is lower, the sublimation rate is reduced so as to avoid the incorporation of impurities by increasing or decreasing the pressure and/or the heating temperature in the apparatus, while the sublimation is accelerated by aerating the inner space of the apparatus with an inert gas such as rare gases when the amine compound is less sublimatable. The size of crystals obtained by sublimation can be controlled by elevating or reducing the temperature on the condensation surface in the apparatus: When the condensation surface is kept at a temperature slightly lower than the heating temperature so that the amine compound gradually crystallize, one can obtain crystals in larger sizes.

Please replace the paragraph beginning at page 35, line 16, with the following amended paragraph:

The reference numeral 3 in FIG. 1 represents a hole injection/transportation layer, which is usually formed with a method similar to that used in the anode 2 by preparing the hole injection/transportation layer material into a membrane with a thickness of 1 to 1,000 nm while allowing it to contact with the anode 2. As to hole injection/transportation layer materials, it is desirable to choose a material which exhibits a low ionization potential and a hole mobility of, for example, at least 10^{-6} cm²/V·second under an electric field of 10^4 to 10^6 V/cm so as to facilitate the injection and transportation of holes from the anode 2. Particular hole injection/transportation layer materials are, for example, arylamine, imidazole, oxadiazole, oxazole, triazole, chalcone, styryl anthracene, stilbene, tetraarylethene, triarylamine, triarylethene, triarylmethane, phthalocyanine, fluorenone, hydrazone, N-vinylcarbazole, pyrazoline, pyrazolone, phenylanthracene, phenylenediamine, polyarylethane, polysilane, polyphenylenevinylene, and porphyrin derivatives, which are usually used in organic EL devices: These may be used in combination, if necessary. Among these, the much more preferable are monomers and polymers in an aromatic ~~tertial~~

tertiary amine form, which are of arylamines such as monoarylamine, diarylamine, triarylamine and tetraarylamine.

Please replace the paragraph beginning at page 40, line 20, with the following amended paragraph:

The reference numeral 5 in FIG. 1 represents an electron injection/transportation layer, which is usually formed with a method similarly as in the anode 2 by preparing one or more organic compounds high in electron affinity or, for example, anthraquinodimethane, anthrone, oxadiazole derivatives, carbodiimide, distyrylpyrazine, diphenylquinone, silazane, thiopyrandioxide, triazole, tetracarboxylate of heterocyclic compound, phthalocyanine, fluorenone derivatives, quinolinol metal complexes similar to those in the luminescent layer 4, or a conductive oligomer or polymer of repeating aniline, ~~thiophen~~-thiophene or pyrrole units into a membrane with a thickness of 10 to 500 nm while allowing it to contact with the luminescent layer 4. In case that a plurality of electron injection/transportation layer materials are used, they may be mixed to homogeneity and then formed into a single layer, and alternatively formed into a plurality of separate layers without premixing while allowing each layer to contact with its adjacent layer(s). In case of providing a hole-blocking layer, a hole-blocking layer material, for example, an oxadiazole compound such as 2-biphenyl-4-yl-5-(4-tert-

butylphenyl)-1,3,4-oxadiazole, 2,2-bis[5-(4-biphenyl)-1,3,4-oxadiazole-2-yl]-1,4-phenylenehexafluoropropane, and 1,3,5-tris-(2-naphthalene-1-yl-1,3,4-oxadiazole-5-yl)benzene is prepared into a membrane with a method similar to that used in the anode 2 while allowing it to contact with the luminescent layer 4, prior to the formation of the electron injection/transportation layer 5. The thickness of such a hole-blocking layer is set to a level in the range of 1 to 100 nm, usually, 5 to 50 nm while considering the thickness of the electron injection/transportation layer 5 and the operation characteristics of organic EL devices.

Please replace the paragraph beginning at page 42, line 12, with the following amended paragraph:

As explained heretofore, the organic EL device of this invention can be obtained by providing in one device an anode, luminescent layer, cathode, and arbitrarily a hole injection/transportation layer, electron injection/transportation layer, and/or hole-blocking layer on the same substrate while allowing each layer to contact with their adjacent layer(s). During the formation of each layer, it is desirable to carry out all the working steps under high vacuum conditions, particularly, at a pressure of 10^{-5} Torr or lower to minimize the oxidation and decomposition of organic compounds, as well as to minimize the adsorption of oxygen and

water. In the formation of a luminescent layer, the ratio of host and guest compounds can be adjusted by premixing them in a prescribed ratio, and alternatively by separately controlling the heating velocities for respective compounds in vacuum sublimation. To minimize deterioration under operation conditions, it is desirable either to seal a part or the whole of the organic EL device thus obtained with a sealing glass or metallic cap in the stream of an inert gas, or to coat or cover it with a moisture-proof paint or protecting layer such as those of ultraviolet-setting resins. ~~Dependently-Depending~~ upon the structures of organic EL devices, in order to allow the luminescent layer to release a luminescence outside the device with an improved efficiency, one can employ one or combination of diffracting means which change the incident angle of the luminescence ~~against~~ with respect to the luminescence-releasing plane in the device, for example, bracelet plates and reflection or transmission gratings in one- or two-dimensional type to suppress the total reflection at the interface between the organic and inorganic layers in the devices and/or the luminescence-releasing plane and the air.

Please replace the paragraph beginning at page 43, line 9, with the following amended paragraph:

The following will illustrate the way of using the organic EL device of this invention: It is driven by intermittently energizing it with a relatively high pulse voltage, or continuously energizing it with a relatively low non-pulse voltage, usually, 2 to 50 V, ~~dependently~~ depending upon its uses. The organic EL device of this invention gives a luminescence only when anode potential exceeds cathode potential. Thus, both dc or ac voltages are feasible to energize the organic EL device of this invention, and the waveform and frequency of such a voltage is ~~arbitrary~~ arbitrarily chosen. When energized with ac, the organic EL device of this invention increases and decreases the brightness of luminescence, and repeat on/off for luminescence due to its principle, dependently upon the waveform and frequency of ac to be energized. In the case of the organic EL device in FIG. 1, when a voltage is energized between the anode 2 and cathode 6, holes injected from the anode 2 move into the luminescent layer 4 through the hole injection/transformation layer 3, and electrons injected from the cathode 6 move into the luminescence layer 4 through the electron injection/transportation layer 5. As a result, the holes and electrons recouple in the luminescent layer 4, and

the prescribed luminescence is released from luminescent layer materials in an excited state through the anode 2 and the substrate 1. Dependently upon the structures and ratio of the amine compound and the host and guest compounds to be used in combination, the organic EL device of this invention usually has a maximum for luminescence such as fluorescence at a wavelength of 500 to 650 nm in the green to red region. The x value for such luminescence is usually in the range of 0.01 to 0.73, and the y value, in the range of 0.26 to 0.83 on the xy chromaticity diagram established by the International Commission on Illumination (CIE).

Please replace the paragraph beginning at page 44, line 8, with the following amended paragraph:

The organic EL device of this invention would find a variety of uses in information displaying equipments to visualize information, for example, those in images and words and also in light sources or luminous bodies in illuminants in general because it is superior in durability, high in emission efficiency and as a result open to the elevation of brightness while suppressing its power consumption. Particularly, in the information displaying equipments, the organic EL device of this invention can be prepared into light panels with a desired form and size in usual manner to apply it to electric machine apparatuses, electronic- and optical-equipments in

general to be required for a visualized display of information, such as video displays in computer-related apparatuses, televisions, telephones, computerized game consoles, calculators, cameras, clocks, car navigation systems; measuring instruments in general; signs; signboards; and advertising panels, which are directed to uses at home and professional uses. In such a case, the organic EL device of this invention may be driven by applying thereto a driving circuit of conventional simple or active matrix type usually used in this art while using it alone or combining with other organic EL devices which emit a visible light in the blue, green and/or red region and appropriate filters to control luminescent chromaticity and color tone, if necessary. In case of using in illuminants, the organic EL device of this invention is prepared into a light panel with a desired form and size in usual manner so that it is feasible as energy- and space-saving light source in illuminants in general such as interior or exterior illuminations, backlights for liquid crystal elements, illuminants usable to physical medicines for treating depression, and illuminants for controlling photoperiodism and phototaxis in animals and plants such as farm animals, poultry, fish and ~~shellfishesshellfish~~shellfish, insects, fruit trees, cereals, vegetables, and flowers and ornamental plants. Organic EL devices according to this invention, using

in the anode and cathode a set of reflecting mirrors which function as optical microcavity, are useful in, for example, non-threshold lasers operable in a less current region.

Please replace the paragraph beginning at page 49, line 4, with the following amended paragraph:

Although the amine compounds of this invention, including those represented by Chemical Formulae 1 to 50, are slightly different in starting reaction conditions and yields ~~dependently~~ depending on their structures, they can be obtained by the methods in Examples 1 to 4 or in accordance therewith.

Please replace the paragraph beginning at page 49, line 10, with the following amended paragraph:

A multi-layer type of organic EL device with the structure of FIG. 1 was prepared by using an amine compound according to this invention as luminescent agent in organic EL devices. A glass substrate with a transparent ITO electrode, 160 nm thick, was patterned with a hydrobromic acid in usual manner, washed with organic alkali detergent, refined water, acetone and ethanol in the given order under ~~ultrasenical~~ ultrasomic conditions, dried, aerated with ultraviolet ozone to remove organic impurities from the surface of ITO electrode, and transferred to the pretreatment room in a

vacuum depositing apparatus. The pretreatment room was then reduced to give an inner pressure of 1×10^{-6} Torr, injected with a mixture of argon and oxygen gases to give an inner pressure of 1×10^{-2} Torr, and subjected to plasma treatment, thus obtaining a clean substrate 1 with ITO electrode as the cathode 2.